SAINT LOUIS UNIVERSITY.

Program-Level Assessment: Annual Report

Program Name (no acronyms): Biomedical Engineering	Department: Biomedical Engineering
Degree or Certificate Level: B.S.	College/School: School of Science and Engineering
Date (Month/Year): 10/2023	Assessment Contact: Marta Cooperstein

In what year was the data upon which this report is based collected? AY 2022-2023

In what year was the program's assessment plan most recently reviewed/updated? 2023

Is this program accredited by an external program/disciplinary/specialized accrediting organization? Yes

1. Student Learning Outcomes

Which of the program's student learning outcomes were assessed in this annual assessment cycle? (Please list the full, complete learning outcome statements and not just numbers, e.g., Outcomes 1 and 2.)

In this annual cycle, we assessed all five of our stated HLC student learning outcomes. Because ABET accreditation cycle requires outcomes to be assigned to courses, each year of a 3-year cycle (2 cycles per ABET review) we look at a different set of courses. This year, the courses that were common to both the ABET and University assessment processes were BME 2000, BME 2200, BME 3300, BME 3840, BME 4600, BME 4960, and BME 5965.
The assessed student learning outcomes were as follows:
Outcome 1: Graduates will demonstrate an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics. (ABET 1).
Outcome 2: Graduates will demonstrate an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives. (ABET 5)
Outcome 3: Graduates will demonstrate an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgements, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. (ABET 4).
Outcome 4: Graduates will communicate effectively with a range of audiences. (ABET 3)
Outcome 5: Graduates will be able to solve bio/biomedical engineering problems, including those associated with the interaction between living and non-living systems. (ABET BME B).

2. Assessment Methods: Artifacts of Student Learning

Which artifacts of student learning were used to determine if students achieved the outcome(s)? Please describe the artifacts in detail and identify the course(s) in which they were collected. Clarify if any such courses were offered a) online, b) at the Madrid campus, or c) at any other off-campus location.

BME artifacts include specific homework, quiz and exam questions, specific sections of reports from projects, oral presentations, poster presentations and prototypes of student's designs. We also have extensive student survey data, but survey data is not included in this report. For AY 2022 - 2023 we collected artifacts from the following courses: BME 2000, BME 2200, BME 3300, BME 3840, BME 4600, BME 4960, and BME 5965. Here is the list of which artifacts were collected and evaluated in which course:
BME 2000: homework, quizzes, in-class exercises, projects, exams
BME 2200: Homework, quizzes, exams, projects, in-class exercises, oral presentation
BME 3300: homework, exams, class participation, oral report, written assignment
BME 3840: pre-lab and post-lab exercises, in-lab performance, lab notebook, reports
BME 4600: projects, exams, problem sets
BME 4960: oral presentations, reports, peer assessment
BME 5965: Oral presentation, written report, poster presentation

None of the artifacts were collected from the Madrid campus, or other off-campus locations. None of the courses were delivered in an online / hybrid format.

3. Assessment Methods: Evaluation Process

What process was used to evaluate the artifacts of student learning, and by whom? Please identify the tools(s) (e.g., a rubric) used in the process and **include them in/with this report document** (please do not just refer to the assessment plan).

The evaluation occurs in three phases. In phase one, faculty teaching the course identify and perform quantitative analysis of each artifact type corresponding to each outcome. This analysis results with the artifacts being assigned the letters A, B, and C, where an A corresponds to greater than 80% of the artifacts received a passing score (>70%), B corresponds to greater than 60% of the artifacts received a passing score, and C corresponds to less than 60% of the artifacts received a passing score. This evaluation is documented in the Form 3_5 under 'Phase 1 assessment.'
In phase two, faculty fill out ABET outcome evaluation rubrics for each artifact, reflecting the degree to which each artifact corresponds to the desired response. These evaluations are converted to the letters A, B and C, where an A corresponds to greater than 80% of the artifacts fall within the 'satisfactory' or 'exemplary' categories, B corresponds to greater than 60% of the artifacts falling within the 'satisfactory' or 'exemplary' categories, and C corresponds to less than 60% of the artifacts falling within the 'satisfactory' or 'exemplary' categories. This evaluation is documented in the Form 3_5 under 'Phase 2 Assessment.' In phase three, the entire BME faculty meet to discuss and evaluate the forms and the outcome rubrics.
The 3_5 form and the learning outcome rubrics are included with this report.

4. Data/Results

What were the results of the assessment of the learning outcome(s)? Please be specific. Does achievement differ by teaching modality (e.g., online vs. face-to-face) or on-ground location (e.g., STL campus, Madrid campus, other off-campus site)?

Outcome 1: Graduates will demonstrate an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics. This outcome was assessed through artifact collection in courses across sophomore, junior, and senior level courses. In each of these courses the outcome was assessed to be at Level-A achievement (>80% of the artifacts received passing scores).

Outcome 2: Graduates will demonstrate an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives. This outcome was assessed through artifact collection in courses representing sophomore, junior, and senior levels. In each of these courses the outcome was assessed to be at Level-A achievement (>80% of the artifacts received passing scores).

Outcome 3: Graduates will demonstrate an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgements, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. This outcome was assessed through artifact collection in three courses representing junior and senior levels. In each of these courses the outcome was assessed to be at Level-A achievement (>80% of the artifacts received passing scores).

Outcome 4: Graduates will demonstrate communicate effectively with a range of audiences. This outcome was assessed through artifact collection in three courses representing junior, and senior levels. In each of these courses the outcome was assessed to be at Level-A achievement (>80% of the artifacts received passing scores).

Outcome 5: Graduates will be able to solve bio/biomedical engineering problems, including those associated with the interaction between living and non-living systems. This outcome was assessed through artifact collection in three courses representing junior, and senior levels. In each of these courses the outcome was assessed to be at Level-A achievement (>80% of the artifacts received passing scores).

5. Findings: Interpretations & Conclusions

What have you learned from these results? What does the data tell you?

Our data suggests that the students are achieving the desired level of performance with respect to each of our assessed outcomes.

6. Closing the Loop: Dissemination and Use of Current Assessment Findings

A. When and how did your program faculty share and discuss these results and findings from this cycle of assessment?

Our faculty keep a Google folder of all our assessments and artifacts. We have a program meeting each semester to view and discuss the assessments of our courses (exemplar artifacts viewed as needed). This allows all faculty to observe assessment techniques and opportunities while providing feedback and allowing for continuous improvement.

B. How specifically have you decided to use these findings to improve teaching and learning in your program? For example, perhaps you've initiated one or more of the following:

Changes to the Curriculum or Pedagogies	• Course content • Teaching techniques • Improvements in technology • Prerequisites	• Course sequence • New courses • Deletion of courses • Changes in frequency or scheduling of course offerings
Changes to the Assessment Plan	• Student learning outcomes • Artifacts of student learning • Evaluation process	• Evaluation tools (e.g., rubrics) • Data collection methods • Frequency of data collection

Please describe the actions you are taking as a result of these findings.

Based upon high student achievement of outcomes (with all being achieved at Level A) we are not planning for changes to curriculum or the assessment plan. We are planning on adding performance indicators to the BME-specific outcomes in our scoring rubrics (Outcomes A through D).

If no changes are being made, please explain why.

Based on our assessment, students obtained a high level of achievement in the outlined outcomes in all courses evaluated this academic year. Previously, we have generated performance indicators and official scoring rubrics for each outcome (outcomes 1-7). We have also changed outcomes in alignment with a change implemented by ABET. See below for the discussion of these past changes and our findings.

7. Closing the Loop: Review of Previous Assessment Findings and Changes

A. What is at least one change your program has implemented in recent years as a result of assessment data?

We have created performance indicators and official scoring rubrics for all student outcomes and started using them for data assessment and analysis in the Fall '21.

B. How has this change/have these changes been assessed?

Each faculty filled out the Form 3_5 for each course scheduled for assessment. The entire BME faculty met to review, discuss, and evaluate the assessment forms and the outcome rubrics.

C. What were the findings of the assessment?

The use of performance indicators and rubric outcomes allows us to decouple student outcomes from student grades. Our analysis appears to validate this assessment method. We observed that students achieved passing grades while also obtaining a high level of achievement in the student learning outcomes.
The performance indicators also allow us to more closely investigate the types of assignments given to students and how these assignments assess the outcomes.

D. How do you plan to (continue to) use this information moving forward?

We continue to focus on student generated content, and look not only at the grades, but also at what level students' work achieves the assigned outcomes. This puts more emphasis on the performance indicators and scoring rubrics rather than just assignment grades for determining outcome achievement. Each faculty can modify the assignments or add new assignments in their courses to better assess the outcomes, if deemed necessary.

IMPORTANT: Please submit any assessment tools (e.g., artifact prompts, rubrics) with this report as separate attachments or copied and pasted into this Word document. Please do not just refer to the assessment plan; the report should serve as a stand-alone document.

Current ABET Learning Outcomes & BME Specific Criteria

ABET Student Learning Outcomes
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science and mathematics
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. An ability to communicate effectively with a range of audiences
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgements, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

ABET BME Specific Criteria
A. Applying principles of engineering, biology, human physiology, chemistry, calculus-based physics, mathematics (through differential equations) and statistics
B. Solving bio/biomedical engineering problems, including those associated with the interaction between living and non-living systems
C. Analyzing, modeling, designing, and realizing bio/biomedical engineering devices, systems, components, or processes
D. Making measurements on and interpreting data from living systems

Outcome #1: An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science and mathematics

	Unsatisfactory	Developing	Satisfactory	Exemplary
Formulate the problem and identify key issues / variables	- Missing problem formulation - Missing most key issues/variable - Missing most criteria - Missing most constraints - Missing most assumptions	- Weak problem formulation - Some issues/variables identified, but many missing - Many criteria missing - Many constraints missing - Many assumptions missing	- Adequate problem formulation - Most key issues/variables are identified - Almost all criteria presented for ranking alternatives - Almost all constraints identified - Almost all assumptions identified	- Complete and succinct problem formulation - Key issues/variables identified - All relevant criteria presented for ranking alternatives - All relevant constraints identified - All relevant assumptions identified
Recognize the need or potential for multiples solutions	- Alternative solutions are not presented	- Alternative solutions are not significantly different or only involve a minor parameter change	- Alternative solutions adequately cover design space - Variety of tradeoffs are presented in alternative solutions	- Alternative solutions cover design space in several significant dimensions - All significant tradeoffs are presented in alternative solutions
Analyze alternative solutions to an engineering problem	- Little analysis - Severely flawed analysis - Criteria not evaluated - Constraints ignored	- Limited analysis of alternatives - Only some criteria evaluated - Only some constraints considered	- Appropriate analysis approach - Mostly correct analysis results - Criteria evaluated with minor errors - Constraints considered with minor errors	- Well thought out or clever analysis approach - Complete and correct analysis results - Complete evaluation of design criteria - Complete consideration of constraints
Justify a solution to an engineering problem	- Little discussion of analysis results - Missing documentation of design-making process - Arbitrary choice for final solution	- Weak discussion of analysis results - Missing significant steps in decision-making process - Weak justification for final solution	- Adequate discussion of analysis results - Document decision-making process - Final solution justified based upon design criteria	- Detailed discussion of analysis results - Detailed documentation of decision-making process - Clear justification for final solution based upon design criteria

Outcome #2: An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors

	Unsatisfactory	Developing	Satisfactory	Exemplary
Formulate the problem, identify the need, and analyze constraints	- Unable to formulate the problem at all - Does not understand the concept of constraints	- Partial formulation, but missing some key constraints - Understands the concept of constraints but is unable to formulate the problem	- Formulates the problem and uses constraints in formulation - Unable to use the most efficient formulation	- Formulates the problem and analyzes all relevant constraints - Finds the best formulation
Establish criteria for evaluating potential solutions and tradeoffs	- Unable to establish fitness criteria - Does not understand the concept of tradeoffs	- Somewhat able to establish fitness criteria and tradeoffs with major weaknesses - Misses several critical tradeoffs	- Establishes fitness criteria and tradeoffs with minor weaknesses	- Establishes complete fitness criteria - Analyzes tradeoffs thoroughly
Generate alternative solutions	- Unable to derive any meaningful solutions	- Derives a meaningful solution - Unable to derive alternative solutions	- Derives multiple solutions - Has some weaknesses in evaluation of alternative solutions	- Derives alternative solutions - Performs proper evaluation of alternative solutions
Develop a prototype (theoretical OR physical) and analyze performance	- Unable to build a proper prototype	- Builds a prototype with some help - Shows major weaknesses in analyzing performance	- Builds an adequate prototype - Somewhat able to analyze performance	- Builds a well-developed prototype - Fully analyzes the performance
Improves upon prototype (i.e. reiterate, painstorm, identify weaknesses, etc.)	- Unable to identify weaknesses in prototype	- Identifies some weaknesses in prototype, but still missing some important items - Unable to make any improvement to the prototype	- Identifies key weaknesses in prototype - Makes some improvements to eliminate major weaknesses, but minor weaknesses not addressed	- Identifies any weakness in prototypes - Remedies any weakness in prototype - Determines the best prototype

Outcome #3: An ability to communicate effectively with a range of audiences

	Unsatisfactory	Developing	Satisfactory	Exemplary
Organize the material to be communicated, with any accompanying slides designed to look both professional and graphically appealing.	- Little organization - Missing problem statement - Mission conclusion/summary - Missing other major sections - Missing references - Too much or small-font text - Missing /Low-quality graphics - Slides do not support speaker	- Confusing organization - Weak problem statement - Weak conclusion or summary - Other sections are weak - Weak list of references - Slides not graphically appealing (e.g. white space) - Verbiage not clear and concise	- Mostly logical and complete organization - Adequate problem statement - Adequate conclusion/summary - Adequate list of references - Slide content is clear - Images are relevant	- Excellent organization - Well-stated problem statement or purpose - Strong conclusion or summary - Thorough list of references - Images enhance the message - Text clear and concise - Very graphically appealing
Presents content in own words, demonstrating comprehension of material	- Lacking information or information is inaccurate or irrelevant - Significant text has been plagiarized - Presents little understanding of topic	- Some basic information, but some is inaccurate or irrelevant - Some text may be plagiarized - Presents basic understanding of some parts of the topic	- Adequate information with a few minor errors or omissions - Adequate research - Text is mostly the author's own, and appropriate citations provided - Presents general understanding of topic	- Exceptional information that is accurate and relevant - Careful and thorough research - All text is the author's own - Presents in-depth understanding and insight
Provide data to support claims or inform the audience	- Ideas not expressed clearly nor supported by details - No interpretation of data - No illustrations, or they do not support the intended message	- Ideas are not expressed clearly OR details are weak - Data analysis is weak - Illustrations are unrelated, confusing, or mislabeled	- Ideas are generally expressed clearly and details are adequate - Data analysis is adequate - Illustrations support ideas, but have some mislabeling or do not present data in the best way	- Ideas are well-developed, expressed clearly with appropriate details - Data analysis is thorough and clever - Illustrations clearly support core message, are properly labeled, and captioned
Demonstrate proper use of English	- Numerous errors in grammar, punctuation, and spelling - Many sentences have an awkward construction - Does not appear to have been proofread	- Several errors in grammar, punctuation, and spelling - Several sentences have an awkward construction - Proofreading appears to have been done hastily	- A few errors in grammar, punctuation, and spelling - Sentences are mostly well-crafted - Appears to have been proofread, but further revision could improve text	- Minor errors, if any, in grammar, punctuation, and spelling - Varied and creative sentence structures - Demonstrates thorough proofreading and revision
Deliver an oral presentation that is well-rehearsed and synchronized to any accompanying slides	- Control of speaking tone, clarity, and volume is poor - Speaker visibly nervous; does not convey interest in topic - Speaker fails to make eye contact with audience - Absent awareness of physical gestures and facial expression - Presentation not synchronized to slide content	- Clarity of speech is uneven, delivery is halting - Speaker is not completely sure of topic and appears nervous or disengaged - Limited or sporadic eye contact with audience - Limited or inappropriate use of gestures or facial expression - Speaker is reading the slides	- Good speaking voice; recovers easily from speaking errors - Speaker is in command of the topic but appears slightly nervous in delivery - Good eye contact with audience throughout most of presentation - Use of physical gestures and facial expression is good	- Strong, clear speaking tone easily understood by audience - Speaker conveys confidence in talking about the topic - Excellent eye contact with audience throughout presentation - Use of physical gestures and facial expressions conveys energy and enthusiasm

Outcome #4: An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgements, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts

	Unsatisfactory	Developing	Satisfactory	Exemplary
Identify the global, economic, environmental, and societal context of an engineering problem or scenario	- Unable to identify relevant context of the problem - Relevant contexts described in an extremely limited fashion	- One relevant context of the four listed context types identified - The one relevant context described in only a rudimentary fashion	- Relevant context among two or three of the four listed context types recognized - At least two contexts described substantively	- Relevant contexts among three or four of the four listed context types identified - At least three of the contexts described thoroughly
Describe ethical and professional responsibilities related to an engineering project	- Description of ethical and professional responsibilities absent or extremely limited	- Description of ethical and professional responsibilities is rudimentary	- Description of ethical and professional responsibilities is substantive	- Description of ethical and professional responsibilities is complete and thorough
Explain the impact of engineering decisions in a global, economic, environmental, and societal context	- Explanation of relevant impacts of engineering decisions is absent or extremely limited	- Explanation of engineering decisions impact touches on only one context - Explanation of relevant impacts of engineering decisions is rudimentary	- Explanation of relevant impacts of engineering decisions touches on two or three of the provided contexts - Explanation is substantive in the majority of contexts	- Explanation of relevant impacts of engineering decisions touches on three or four of the contexts - Explanation is at least substantive in all contexts and is thorough in the majority

Outcome #5: An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives

	Unsatisfactory	Developing	Satisfactory	Exemplary
Establish a collaborative and inclusive team environment	- Does not provide encouragement or constructive criticism - Does not listen to other teammates or share knowledge - Does not help other teammates or demonstrate leadership	- Sometimes provides encouragement and constructive criticism - Sometimes listens to other teammates and shares knowledge - Sometimes helps other teammates and demonstrates leadership	- Frequently provides encouragement and constructive criticism - Frequently listens to others and shares knowledge - Frequently helps other teammates and demonstrates leadership	- Always provides encouragement and constructive criticism - Always listens to other teammates and shares knowledge - Always helps other teammates and demonstrates leadership
Fulfill individual responsibilities and contributes to the team's success	- Does not complete individual tasks timely - Does not contribute to the team efforts - Does not interact with the other team members	- Completes small number of individual tasks timely - Contributes little to the team efforts - Interacts little with other team members	- Completes most of the individual tasks timely - Contributes frequently to the team efforts - Interacts regularly with other team members	- Completes all individual tasks timely - Always contributes to the team efforts - Always interacts with other team members
Define team goals and deadlines, plan tasks, organize and facilitate effective team meetings	- Does not define any goals or deadlines - Does not plan shared or individual tasks - Does not organize nor facilitate any part of the team meetings	- Defines at least one goal with a deadline - Plans at least one shared and one individual task - Organizes and facilitates at least one part of one team meeting	- Defines a few necessary goals with deadlines - Plans a few necessary shared and individual tasks - Organizes and facilitates a few parts of a few team meetings	- Defines several necessary goals with deadlines - Plans several necessary shared and individual tasks - Organizes and facilitates several parts of several team meetings

Outcome #6: An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

	Unsatisfactory	Developing	Satisfactory	Exemplary
Design and / or evaluate an experimental plan	- Missing experimental plan / evaluation - Missing driving or key questions - Missing the identification of critical variables - Missing data collection procedures	- Flawed experimental plan / evaluation - Weak driving questions - Majority of key variables are not identified - Data collection procedure is formulated poorly	- Adequate experiment plan / evaluation - Driving questions are presented, although it may have minor flaws - Almost all variables have been identified - Data collection procedure is formulated adequately, but does not account for all externalities	- Well thought out experimental plan / evaluation - Driving question is appropriately narrow and focused - All relevant variables and externalities have been identified - Data collection procedure is detailed without being unnecessarily complicated
Acquire data on appropriate variables	- Data acquisition appears to have significant errors or unrealistic accuracy - Data collected for variables that are not part of experiment plan OR key variables are not sampled - Missing large portions of data	- Data acquisition does not include any detail on instrument precision or accuracy performance - Acquired data is not accompanied by a data acquisition illustration or diagram - Input data range is significantly limited or obviously meaningless for some variables	- Data acquisition includes most instrument capabilities - Data acquisition setup is illustrated/explained, but a few minor details are missing - Input data covers most of the range of interest for the key variables	- Data acquisition includes all relevant sensitivity and calibration information - Data acquisition setup is carefully and thoroughly explained - Input data covers entire range of interest
Interpret experimental data and results with respect to appropriate theoretical models or anticipated outcomes	- No comparison made, or comparison made to irrelevant models / outcomes	- Weak comparison of data to an appropriate model / outcome - Comparison of data made to model that doesn't include some important relationships among key variables	- Adequate comparison made to appropriate model / outcome - Model includes important relationships among key variables, though some minor details are missing	- Thorough comparison conducted between sufficiently varied data set and a detailed model / outcome - Theoretical model is sufficiently detailed to provide insight to answering driving question
Explain observed differences between model and experiment and draw conclusions	- Differences are not identified or are incorrectly explained - Neither the possibility of using the wrong model nor of collecting erroneous data has been identified - Conclusions are not justified	- Most differences are correctly identified, but many are poorly explained - Explanation of differences does not consider use of wrong model or possible erroneous data - Conclusions are weakly justified	- All major differences are identified; only a few minor differences have been ignored - Both model and data have been explored as possible sources of error - Conclusions are partially justified by analysis	- All relevant differences have been identified - Potential weaknesses in both model and data collection have been identified, and both are well done - Conclusions are fully justified by rigorous analysis

Outcome #7: An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

	Unsatisfactory	Developing	Satisfactory	Exemplary
Identify necessary techniques, skills, and tools / resources for advancing research or technology	- Identifies a small subset of necessary techniques, skills, and tools / resources - Identifies unrelated techniques, skills, and tools / resources	- Identifies some techniques, skills, and tools / resources, but missing some important items - Includes some unrelated techniques, skills, and tools / resources	- Identifies almost all of the relevant techniques, skills, and tools / resources - Missing some minor techniques, skills, and tools / resources	- Identifies all relevant techniques, skills, and tools / resources
Explain the use of the new techniques, skills, and tools / resources	- Provides little explanation of how the techniques, skills, and tools / resources should be used - Provides incorrect explanation of how to use the techniques, skills, and tools / resources	- Explains how some techniques, skills, and tools / resources should be used, but missing some important items - Provides some incorrect explanations of how to use the techniques, skills, and tools / resources	- Explains how almost all of the techniques, skills, and tools / resources should be used - Shows adequate understanding of techniques, skills, and tools / resources - Missing the explanation of some minor techniques, skills, and tools / resources	- Explains how all relevant techniques, skills, and tools / resources should be used - Shows in-depth understanding of techniques, skills, and tools / resources - Does not explain unrelated aspects of techniques, skills, and tools / resources
Apply the new techniques, skills, and tools / resources to a given engineering situation	- Applies a small subset of the necessary techniques, skills, and tools / resources - Incorrectly applies the techniques, skills, and tools / resources	- Correctly applies some of the techniques, skills, and tools / resources, but missing some important items - Incorrectly applies some techniques, skills, and tools / resources	- Correctly applies almost all of the techniques, skills, and tools / resources - Demonstrates adequate use of techniques, skills, and tools / resources - Incorrectly applies some minor techniques, skills, and tools / resources	- Correctly applies all relevant techniques, skills, and tools / resources - Demonstrates mastery of techniques, skills, and tools / resources - Does not apply unnecessary techniques, skills, and tools / resources

Course Number:
Course Title:
Semester:

Instructor:
Date Completed:
Programmatic Review Date:

Course Grade Distribution

Grade	F	D	C-	C	C+	B-	B	B+	A-	A
Number of Students										

Phase-1 (Direct) Assessment of Student Outcomes

For each student outcome indicate the *Phase-I* assessment methods used (see appendix). For each method listed please provide a more specific description of the assessment method, rank the achievement level, and provide quantitative evidence to support the achievement level.

Table F3.5-1: Summary of Phase-1 Assessment

Summarize the phase-1 measures, and based on that data, determine the overall level of achievement.

Outcome	Phase-1 Assessment Level
1	
2	
3	
4	
5	
6	
7	
A	
B	
C	
D	

Phase-2 (Indirect) Faculty Assessment: *Discuss the basis for the indirect faculty assessment here. Please also provide your overall class assessment and, if necessary, an action plan to address concerns.*

Outcome	Unsatisfactory	Developing	Satisfactory	Exemplary	Overall Level
1					
2					
3					
4					
5					
6					
7					

Outcome	Unsatisfactory	Developing	Satisfactory	Exemplary	Overall Level
A					
B					
C					
D					

Table F3.5-2: Summary of Phase-1 and Phase-2 Assessments

Summarize the phase-1 and phase-2 measures and, based on that data, determine the overall level of achievement.

Outcome	Phase-1 Assessment Level	Phase-2 Assessment Level	Overall Assessment Level
1			
2			
3			
4			
5			
6			
7			
A			
B			
C			
D			

Appendix

Student Outcome Assessment Methods

The assessment of student outcomes is a coordinated process involving the program constituents and designed to meet the institutional mission. The following sections describe the methods used, results, and analysis.

Phase-1 (Direct) Assessment Methods: These methods range from homework and exams to oral presentations and large-scale projects. There are seven general types categorized below. Achievement levels are obtained through graded measurements and/or rubric measurements.

1. *homework, quizzes, exams:* This method is based on assignment or problem grades that are focused on specific program outcomes.

2. *computer assignments and projects:* This method is based on assignment or project grades that are based on computer programming or simulations related to program outcomes.

3. *laboratory experiments and projects:* This method is based on grades from laboratory experiments or course projects.

4. *oral reports and exams:* This method is based on grades and assessment rubrics from oral reports or exams.

5. *written reports and essays:* This method is based on grades and assessment rubrics from written reports or essays.

6. *Portfolios, surveys, reflections, and critical reviews:* This method is based on grades and assessment rubrics from portfolios, student surveys, reflections, peer assessments, or critiques of papers.

7. *team and class participation:* This method is based on grades and assessment rubrics based on team or class participation.

Table 1 Assessment Outcome Achievement Level for Graded Measurements

Level-A	Greater than 80% of students received a passing grade (>70%). Strong indication that outcome is sufficiently addressed.
Level-B	Greater than 60% of students received a passing grade (>70%). Outcome is addressed but faculty should monitor closely during next cycle.
Level-C	Less than 60% of students received a passing grade (>70%). Marginal indication that outcome is addressed. Faculty should review before next cycle.

Table 2 Assessment Outcome Achievement Level for Rubric Measurements

Level-A	Greater than 80% of students marked at "Satisfactory" or "Exemplary." Strong indication that outcome is sufficiently addressed.
Level-B	Greater than 60% of students marked at "Satisfactory" or "Exemplary." Outcome is addressed but faculty should monitor closely during next cycle.
Level-C	Less than 60% of students marked at "Satisfactory" or "Exemplary." Marginal

	indication that outcome is addressed. Faculty should review before next cycle.

Table 3 Assessment Outcome Achievement Level for Surveys

Level-A	Greater than 80% of responses were "Strongly Agree" or "Agree." Strong indication that outcome is sufficiently addressed.
Level-B	Between 60% and 80% of responses were "Strongly Agree" or "Agree." Outcome is addressed but faculty should monitor closely during next cycle.
Level-C	Less than 60% of responses were "Strongly Agree" or "Agree." The student outcome requires review by the faculty before next cycle.

Phase-2 (Indirect) Assessment Methods: These methods apply to all student outcomes.

- *student course evaluations:* This method is based on student course evaluations and archived with faculty course evaluations.
- *student advisory board and town hall meetings: S*tudent feedback on the overall curriculum and specific courses is provided through the student advisory board and town hall meetings. Minutes are kept and action items may be initiated based on these discussions.
- *faculty course evaluations:* This method is based on individual faculty assessment of their courses with periodic review by the department of all courses.
- *senior exit survey/interviews and alumni surveys:* The senior exit surveys/interviews are completed at the time of graduation and include the written form and a meeting with the Department Chair or designee. The alumni survey is available on a continuous basis but a recent call for responses resulted in roughly 20% of the alumni submitting their views on the program.